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TI: Physical Properties of 253 Mathilde from Groundbased Observations

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The only physical observations which predate the identification of 253 Mathilde as a potential flyby target of NEAR were measurements of its absolute magnitude in reflected light and thermal radiometry by IRAS. From these measurements a diameter of 58 km and an albedo $p_V = 0.0436$ were computed, indicating that Mathilde is a low-albedo object, probably of C class. Following its selection as a potential flyby target, photometric observations led to a slightly revised albedo determination, and revealed the third-longest rotation period known, of 17.4 days (Mottola *et al.*, Planet. Space Sci. **43**, 1609-1613, 1995), with a lightcurve amplitude of ~ 0.45 magnitude. Furthermore, Mathilde was found to be in a "tumbling", or non-principal axis rotation state. Spectrophotometric observations by Binzel *et al.* (Lecar *et al.*, **119**, 447-449, 1996) confirm the C classification, previously assumed on the basis of albedo. Thus Mathilde has been revealed to be an unusual object, of a class not previously visited by spacecraft. Because of the very slow rotation of Mathilde, no rotational motion will be apparent over the duration of resolved imaging. It is useful to estimate the range of time over which Mathilde will be bright enough to be imaged at all by the camera system. From data on the Martian satellites Phobos and Deimos, we estimate that Mathilde will be ~ 5.8 magnitudes fainter at the approach phase angle of $\sim 140^\circ$ than at zero phase angle, and ~ 1.6 magnitudes fainter at the departure phase angle of $\sim 40^\circ$. These values, along with the absolute magnitude $H = 10.28$ determined from our photometric observations, suggest that Mathilde should be visible with the NEAR camera from ~ 1.7 days before encounter to ~ 12 days after. The short lead time into encounter is worrisome; the considerably longer time after holds some hope that enough of a lightcurve can be obtained to indicate whether the orientation at encounter time was closer to maximum or minimum light, and hence assist in the estimation of volume from the resolved images.

SC: P

DE: 6035

DE: 6055

DE: 6205

MN: FallMeeting1996